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ABSTRACT

Jean Piaget's theories about the development of intelligence and their implications for educational practice are explored. Before Piaget began studying the intellectual processes of children, researchers regarded them as "little adults." He derived his early fame from his theory of the "cognitive stages" of childhood. He realized the remarks of children had meaning and revealed modes of reasoning and judgment different from those of adults. The development of the child's thinking is marked by progressive clarification of ideas from global to differentiated thought. It progresses from absolute to more relativistic thought. It also changes from static to dynamic thought as the child matures. Piaget believed thinking and intelligence were synonymous and stressed thinking as a general capacity. Learning and thinking involve the participation of the learner. He believed knowledge was not transmitted verbally, but that it must be constructed and reconstructed by the thinker/learner. Activity is indispensable to learning and thinking. The way the child moves through the stages of development may be clarified by the concepts of schemata, assimilation, accommodation, and equilibrium. The four stages of cognitive development defined by Piaget are sensory-motor, preoperational, concrete operations, and formal operations. (DWH)

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A Primer on Piaget

William O. Penrose

FASTBACK 128

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WILLIAM O. PENROSE

William O. Penrose was raised in a small farming town in eastern Arkansas where he says conformity was the rule and thinking for oneself was the exception. It was his good fortune, however, to live with his grandfather who prodded his intellectual interests by asking such questions as, "Are you sure you've read the problem?"

His undergraduate degree is in history and political science from the University of Arkansas; his master's and doctorate are in education from Harvard University. He holds a Diplomate in Public Administration from the Institute of Social Science in The Hague.

Penrose has taught at the University of Arkansas, Salem College, Point Park College, Pennsylvania State University, the University of Pittsburgh, and the University of Delaware where he was formerly dean of the School of Education. He is currently adjunct professor, Department of Education, Stetson University, DeLand, Florida.

He has written extensively in the fields of social science and professional education.

Series Editor, Derek L. Burleson

A Primer on Piaget

By William O. Penrose

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Piaget—The Man and His Ideas

In the brief space of a fastback, it would be presumptuous to try to synthesize the contributions of one of the seminal minds of the twentieth century. Rather, I shall attempt to focus on one aspect of Jean Piaget's thinking and research that is most germane to those who work with the young; namely, his theories about the development of intelligence and their implications for educational practice. To do this, it is helpful to know something about the man, his origins, and the development of his ideas about how children think. Let's get acquainted with Jean Piaget.

Jean Piaget was born in Neuchatel, Switzerland, in 1896. He was a curious child with interests in biology, fossils, and mechanics. At the age of 10 he published a scientific paper on birds and became an assistant in the local museum of natural history. He became fascinated with the study of mollusks and eventually published 25 papers on the topic, including a thesis for his studies in biology at the University of Neuchatel from which he was graduated in 1915. These early beginnings of scientific investigations were harbingers of Piaget's lifetime commitment to research, which continues to this day.

Throughout his life, Piaget has been a prolific reader in the fields of philosophy, sociology, and theology. Psychology eventually became his major interest, and after earning his doctorate in 1918, he went to Paris where he worked in a psychological laboratory. There he came to know Theodore Simon, who with Alfred Binet developed the first intelligence test. Simon suggested to Piaget that he work on stan-

dardizing some tests of reasoning, using Parisian children as subjects. Piaget's publications in this field brought him a reputation that resulted in his being offered the position of director of studies at the Institut Jean Jacques Rousseau. This position gave him the freedom to undertake his studies with children out of which developed his theories about the origins of intelligence.

American educators tend to think of Piaget as a psychologist and see his research and theories in the context of child development. Piaget, however, sees himself as a philosopher in that branch of philosophy known as epistemology, which is the study of the origin, nature, methods, and limits of knowledge. In particular, Piaget's interest is in genetic epistemology, which has to do with the genesis or origin of knowledge. He sees himself, first and foremost, as the founder of the science that deals with the nature of knowledge and its development. His own work on children's thinking is, of course, a major contribution to this field of philosophy, but as time went on he realized that genetic epistemology needed the contributions of scholars from other disciplines such as biology, sociology, and logic. In 1956 Piaget founded the International Center for Genetic Epistemology in Geneva, Switzerland, so that scholars from different disciplines could work together in an atmosphere that encouraged freedom and cross-fertilization of ideas.

Piaget's theories explain much about the nature and development of knowledge in children. His work and that of his colleagues has stimulated thinking and research on the subject throughout the world, but his ideas have not been accepted without controversy.

For many years Piaget was ignored or even dismissed by U.S. researchers. Child development specialists of the 1930s and 1940s were dominated by such figures as Gesell. Piaget's research methods with children were different from those being used in the U.S. He was criticized for not using established methods of sampling and experimental investigation. What the critics failed to realize was that Piaget was foremost a philosopher, not a psychologist, and that he was studying the development of thinking in children in order to develop a theory about the nature of knowledge and its development. He wanted to understand what he observed, not merely describe it. He functioned

more as a logician in developing his theories than as a psychologist following strict empirical methods of investigation.

Another reason for the neglect of Piaget during his early years of investigations into children's thinking was that he wrote only in French. It was years before his works were translated into English.

Piaget, whether in French or in English translation, is difficult to read. His theories are usually presented in highly abstract language, although his experimental "games" with children are easy to understand. As a result, Piaget has spawned many "interpreters." This fastback is one effort at such an interpretation. Others are listed in the bibliography.

I have called this fastback a primer; it is just that, a beginning look at Piaget's research and theories that have important implications for both parents and teachers. Hopefully this primer will stimulate you to delve deeper into the man and his ideas.

How Children Think

In studying the origins of knowledge, Piaget first attended to the intellectual processes of children. In the 1920s, when he began this study, little was known about this subject. In fact, to the extent that this topic was considered, researchers tended to regard the child as a "little adult" who knew less than an adult but who reasoned in the same way.

But Piaget, taking nothing for granted, began to question children in depth and listened carefully to their responses. He focused on the strategies they used and the errors they made and came up with what was then the startling conclusion that children at different ages construe the world in ways that are different from the way adults do.

Thus Piaget's early fame derived from his demonstration of the mental operations of children and his theory of "cognitive stages" of childhood.

Following these demonstrations, Piaget's work in the 1930s took two turns.

In order to test the hypothesis that knowledge derives from actions upon the world (genetic epistemology), he began to investigate the signs of intelligence during the first weeks and months of life. And in studying such activities as sucking and looking, he confirmed to his satisfaction that the infant's first acts and discriminations are the earliest signs of intellectual functioning.

At the same time, however, Piaget was not content merely to sketch out a set of developmental stages of cognitive growth. Rather he

wanted to look into the development of knowledge in such domains as number, causality, time, geometry, and the like. He began studies in which the stages of knowledge could be mapped within the human mind. These studies documented that actions could occur "within the head"—in fact, such mental operations are the mainsprings of what is usually called *thought*.

Great discoveries often come from questioning the obvious, for it takes genius to question and see mystery in the commonplace. Variations in the species tantalized Darwin; slips of the tongue and pen intrigued Freud. Jean Piaget's genius lay, in part at least, in having grasped the fact that regardless of how whimsical and nonsensical they seem, the remarks of children have meaning and reveal modes of reasoning and judgment different from those of adults.

Differences in Children's and Adults' Thinking

Before turning to how children think, however, it might be well to describe some differences between the capabilities of children and those of adults, bearing in mind that although these types of thinking seem different in kind, the differences are only temporary, for the child's thought is continually developing adult attributes.

First, the child's thought differs from that of the adult in its relative incapacity for differentiation. Adults can distinguish between what derives from themselves and what derives from their environment—the difference between reality and appearance, between fact and fantasy, between physical and mental. A child, in contrast, is much less aware of these distinctions and does not always discriminate between how things look and how they really are.

Second, children tend to think in absolutes, in sharp dichotomies, and of permanent alterations. They tend to judge others as bad *or* good, admitting no differences in degree. Although adults may regard some people this way, they usually have the capacity to see that others have both good and bad points.

Third and finally, the child's thought is much less dynamic than that of adults. Children see the world in static terms, as a series of still pictures rather than as a cinematic progression. Although they are eager for the new, they seldom see its relation to the old. Adults, how-

ever, are more likely to perceive the world as dynamic and to understand that instances are potential transformations. Growth and change are meaningful concepts to adults but not to children, who see change and growing up as final conditions.

From Global to Differentiated Thought

The development of the child, like the development of a concept in science, is marked by progressive clarification or coming into focus. In science, for example, a concept such as deoxyribonucleic acid (DNA) is first understood only in the simplest terms. As research continues, the innermost structure of the idea becomes revealed. The same holds true for the development of thinking in the child. The child begins at the surface of things and grasps them in what Piaget calls *global* terms. Then, with experience and the growth of mental structures, he examines beneath the surface to study the structure and operation of the phenomena. This progression from global to understanding in depth is called *intellectual differentiation*.

Piaget has provided a multitude of examples of global thought in children between the ages of 2 and 5. He found, for example, that children fail to distinguish between physical and psychic reality. A consequence of this lack of differentiation is that preschool children often attribute life to nonliving things and attribute corporeality to mental events. Piaget has given examples of children who ascribe life to such things as stones and clouds. In one nursery school, a 3-year-old said that his truck was "dead" because it had been knocked over. In other situations one may see children talking to their dolls.

Just as the young child attributes life to inanimate objects, so does he treat mental events as corporeal. Piaget reports studies in which he found that children believe that dreams came in through the window at night and that thought was somehow related to one's mouth and breath. Some young children believe that prayers are like little missiles that are shot toward God. When a preschool youngster with his hand pressed to his jaw was asked whether he had a toothache, he replied, "Yes, can't you feel it?"

Still another facet of this lack of differentiation among preschool children appears in their use of common nouns such as *man* or *dog* or

bike to refer not only to a specific man, dog, or bike, but to all men, dogs, and bikes. Adults distinguish between the particular and the general by means of sentence structure; young children, however, do not differentiate between the one and the many or between the individual and the class. Piaget noted that one of his children once said, "There's that lizard again." She had seen a different lizard the day before. When he was 3 years old, one boy called his stuffed dog *doggie*, but he called other dogs *doggie*, too. Young children can often recognize individual things, but they have trouble when trying to distinguish between the one and the many either verbally or conceptually.

A final example of global thought in children can be culled from children's literature. In fairy tales such as "Hansel and Gretel" or "The Three Bears," one feature stands out: the characters are all one-dimensional. They are described as the manifestation of a single trait. The witch in "Hansel and Gretel" is greedy, and Goldilocks is a poorly brought up and misbehaving youngster. These stories appeal to the young child because they reflect his tendency to think of people in global terms as all good or all bad.

Problems of differentiation are also present in the child of 6 to 11 years of age, but they are of a different kind. The school-age child no longer attributes life to nonliving things or confuses the one with the many. He is able to appreciate fictional characters who have both negative and positive qualities. His thinking is logical and concrete. A failure to differentiate at this age reveals itself when the child fails to distinguish between what he knows and how he came by that knowledge (children of 5 or 6 have learned a great deal from teachers and parents but believe that they themselves have generated all this information.)

Piaget has given many examples of this "amnesia" in school-age children. When, for example, children were asked to explain how they arrived at the answer to an arithmetic problem, their explanations had nothing to do with the processes by which they attained a solution. In addition, Piaget found that children believe that the rules of a game, which they themselves may have made up, were invented long ago and are inviolate. This amnesia for the origins of knowledge makes the elementary school child to some extent both arrogant and optimistic. He

believes that he can discover or invent all knowledge because it is within himself, waiting to be found.

In addition to his amnesia with regard to the origins of his information, the elementary school child fails to recognize what is a creation of his own mind. In solving problems, for example, he assumes that his solution is not a guess or hypothesis that must be tested, but a truth as real as the problem itself. In games such as checkers or ticktacktoe, young school-age children seldom modify their strategies even though they keep losing. They persist because they cannot distinguish between a strategy suggested by the situation and one suggested by their own imagination.

Among adolescents, differentiation is nearly complete, with one exception. Adolescents can, for the first time, construct ideal and contrary-to-fact conditions; they can conceive of utopias and comprehend values and cultures different from their own. Where the adolescent has difficulty, however, is in distinguishing between the possibilities of his imagination and the possibilities of reality. For the adolescent who can conceive of a world without war, poverty, hunger, and illness, there seems to be no reason why these ills cannot be eradicated now.

From Absolute to Relative Thought

As the child matures, his thinking becomes more relativistic. In both physical and social domains, children tend to think in dichotomies. To be sure, children occasionally think in relative terms and adults often think in absolutes, bound by prejudices and stereotyped conceptions. In general, however, children think more in absolutes than do adults. Nowhere is this difference between child and adult thought more evident than in comprehending relationships such as right and left or brother and sister and in moral concepts like good and bad.

Among preschool children, concepts like right and left are understood as properties similar to color or form. The young children see no difference between calling an object *square* and calling it *right*. Piaget demonstrated this by having youngsters stand opposite him and point to his right and left arms and legs. Preschool children who knew their own right and left arms assumed that Piaget's right and left arms were

directly opposite their own. Likewise, when children at this age were asked to say whether the center object in a row of three was on the right or left of one of the others, they would invariably answer, "It is in the middle."

Similar results were obtained from studies of relationships such as brother and sister. Piaget asked a number of preschool children whether they had brothers and sisters. When they answered in the affirmative, he asked whether their brothers or sisters had brothers or sisters. Most of the children claimed that their brothers or sisters did not have brothers or sisters. That is, before the age of 6 or 7 the young child usually does not recognize that he can *have* a brother and *be* a brother at the same time.

The absolutism of the child's thinking is shown in his moral judgments as well. Before the age of 6 or 7, and sometimes even later, children tend to evaluate the gravity of an action absolutely, in terms of the physical damage done, rather than relatively, by taking into account the intentions of the person involved. For example, Piaget read children two stories. In one, a boy broke 12 glasses while helping his mother; in the other, a boy broke one glass while sneaking some jam. Young children judged the boy who had broken 12 glasses more severely than the one who had broken one.

Piaget observed a similar failure to consider intentions when he told some children two other stories, one about a boy who told his mother of having seen an elephant in the street, the other about a boy who told his mother he had received a good mark in school when he had in fact received a bad one. Young children regarded the first boy as more culpable because his tale was so much farther from the truth than was the lie about the grade. The different intentions of the two youngsters were not taken into account in judging their guilt.

Stages in Cognitive Growth

Unlike the preschool youngster, the school-age child has no problem in recognizing that the right and left of the person opposite him are not the same as his own, since he can take the other's point of view and thus establish the relativity of right and left. This is, nonetheless, only a partial relativism, for true relativism appears only when the

young person can take the point of view of many different people at the same time. This does not occur, usually, until the age of 10 or 11, when most children recognize that a pencil between a comb and a knife is at once on the right of the comb and on the left of the knife. This discovery takes capacities that usually do not emerge until early adolescence.

We can discern similar growth in understanding concepts like brother and sister. The school-age child knows that his brother has a brother or sister. However, it is not until early adolescence that children come to understand that "brother" and "sister" are kinship terms and designate the offspring of the same parents. That is, it is not before the age of 10 or 11 that children come to understand that not all children are brothers and sisters and that some children, who are their parents' only children, are not brothers and sisters to anyone.

Likewise, in the area of moral development, there is a gradual understanding of the importance of intention in judging people's actions. Children will say: "He didn't mean it," or "He wanted to help his mother," when they explain why a child who broke 12 glasses is less culpable than a child who broke one. As they move through the elementary school years, children come to regard reprehensive motives as the most important criterion for punishment.

By the time the young person reaches adolescence, he understands the relational character of terms like right and left, brother and sister, and good and bad. Nevertheless, his absolutism appears in the area of ideals and principles. He is intolerant of any breach of principle or any mere approximation of the ideal, and he regards as hypocrites the adults who compromise their principles or do not practice what they preach. The adolescent fails to recognize that valid principles may conflict and call for compromise. The new father who now devotes more time to his family than to his political causes has compromised between two valid principles. As the adolescent matures into adulthood, he comes to understand that principles and ideals do not exist in isolation and that total commitment to a single principle is impossible for most individuals.

Piaget's most recent book in English, *The Grasp of Consciousness* (1976), offers additional studies of how children think. It contains a set of investigations, each conducted with children of several ages, to show

their development with regard to "verbal reflections about one's actions." The book contains many examples of children's responses to tasks posed by Piaget and his collaborators.

The problems are novel ones. In earlier studies, Piaget focused on "content" domains, e.g., knowledge about number or causality. This time he directs our attention to a hitherto uninvestigated facet of children's thinking—how they become aware of, or "know," their own actions; how they "grasp consciousness" with regard to what they have been doing. Throughout the experiments, the tasks are simple, but the processes of becoming conscious about those tasks are complex.

In one experiment, for example, Piaget begins by requiring his subjects to crawl on all fours. He then asks them to tell him what they have done or to describe it by using a teddy bear with jointed limbs; then they are to instruct the interviewer as to how he should crawl on all fours. As students of Piaget will anticipate, the dawn of consciousness proves to be a lengthy, stage-like process. Because of their preconceptions, the children "explain" with a mixture of fact, invention, and fabrication. It is not until they are preadolescents or adolescents (depending on the complexity of the task), that they can finally offer an accurate account of their actions.

From Static to Dynamic Thought

The third way in which children and adults differ in thinking concerns their understanding of permanence and change. Piaget found that when preschool children were shown a series of pictures depicting a growing flower, they did not realize that it was always the same flower. Evidence for the static quality of the young child's thought comes from the experiments that Piaget and his colleagues performed in "conservation." In the conservation problems, children were required to judge whether something changes in amount when it changes in appearance. A child might, for example, be asked whether six pennies in a pile is still the same number when the pennies are put in a row; or whether the amount of orangeade in a tall container is the same as the amount in two smaller containers.

The results of many experiments of this kind reveal that before the age of 6 or 7, most children regard a quantity as changed in amount

when it is changed in appearance. Preschool children usually judge the row of six pennies to be unequal to the pile of six pennies and believe that when a ball of clay is rolled into the form of a sausage it has more clay than it did when it was in the shape of a ball.

In spite of its dynamism, the adolescent mind still thinks statically in the realm of values. Adolescents find it hard to understand their parents' or society's values if these values are different from their own. With experience, however, adolescents understand that values are the product of social forces and must be regarded as relative to circumstances and not as immutable.

Piaget has shown that as the child's mind develops into that of an adult, he develops in dimensions of increased differentiation, increased relativism, and increased dynamism of understanding. But the difference in the thinking of adults and children in these respects is only relative and is primarily that of capacity rather than performance. Although children cannot think as adults do, adults sometimes think as children.

Because of Piaget's studies, the first part of the previous sentence is now as obvious as the second part has always been.

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Piaget and Educational Practice

Piaget has been researching and writing about the science of the nature of knowledge and its development for 60 years. I can deal with only a small part of this topic in this fastback. Therefore, I have chosen to concentrate on Piaget's theories about thinking, since they probably have the greatest relevance for teachers and teaching.

Thinking

Piaget's theories about the nature and development of thinking can help educators and others who work with children to distinguish between thinking and nonthinking activities. Thinking permeates all behavior and is intertwined with action, emotion, and social relations. The only way a person can become intelligent is by acting intelligently, and to act intelligently is to think. While facts are important, they are less important than thinking, if for no other reason than that changes in our technology continue to make many facts obsolete.

Thinking is largely spontaneous and involuntary. It cannot be taught as a subject matter. It begins before a person can speak and it is not limited by language. In this connection it is noteworthy that most other theories of child development give a prominent place to language acquisition. Piaget's theory of development—which is, in effect, a theory of thinking—does not.

Thinking and intelligence are synonymous. Thinking is the use of intelligence; intelligence is the means by which a person thinks. Piaget's theory stresses thinking as a general capacity in contrast to the

views that compartmentalize thinking into abstract thinking, verbal thinking, or perceptual thinking. Thus the thinking that coordinates external actions is the same as the thinking that forms symbols and masters language. In short, thinking is present in actions, in perceptions, in images, and in language, and it can be applied to any concrete area that may interest the person involved.

Developmental View of Thinking

Central to Piaget's developmental view of thinking and learning by discovery is the premise that learning and thinking involve the participation of the learner, whether in relation to objects or to social relationships. In other words, knowledge is not transmitted verbally or otherwise; it must be constructed and reconstructed by the thinker/learner. Therefore, when a child is learning and thinking (that is, when his intelligence is developing) he is going through the process of absorbing his experiences and of integrating them into his internal mental or cognitive structure.

Consequently, activity is indispensable to learning and thinking. To know something is not merely to be told about it or to see it; it is to act upon it, to modify it, and to transform it. In the learning/thinking process there is no distinction between cognitive and affective, for feeling is an aspect of thought. It is because Piaget emphasized the necessity for the child to be active and constructively involved in learning and thinking that he attracted the attention of educators.

Now, if learning, thinking, and knowing involve structuring and restructuring of knowledge, how do these processes occur? For Piaget, the answer to this question lies in understanding the process of the child's cognitive development.

The process of biological development and cognitive development are essentially the same. Just as the child's biological development occurs through organization and adaptation of the organism to the environment, so the same process occurs in intellectual organization and adaptation. Organization is the tendency of living organisms to integrate their experiences and activities into a system. Thus, organization comes about when a child is able to perform two acts (e.g., looking and grasping) that were originally separate behaviors. Adaptation

refers to the ability of the organism to interact with its surroundings. It is this interaction that leads to the development of an increasingly complex mental organization in human beings.

These developmental processes do not occur at random; they follow stages. But before discussing these developmental stages, let's examine the concepts of schemata, assimilation, accommodation, and equilibrium. These concepts clarify the way in which the child moves through the various stages of development.

Schemata are mental categories that influence the ways in which a person sees the world and interprets personal experiences. In a sense, they classify those stimuli that reach the person. A newborn infant has few schemata, but the schemata become increasingly refined, broadened, and numerous, because each time the baby sees or experiences something, he tries to integrate it into his schemata.

Assimilation is the continuous process through which individuals interact with their environment. As individuals meet situations that do not fit into existing schemata, they must either modify the schemata or create new ones to fit the new stimuli. This process is called *accommodation*. The individual adapts through the processes of assimilation and accommodation. The assimilation process forces new stimuli into existing categories; in accommodation, a person's schemata are changed to fit the new stimuli. For cognitive growth to occur, assimilation and accommodation must be in balance; there must be *equilibrium*. And since all organisms seek equilibrium, the child (an organism) is motivated to act when he loses his equilibrium.

The notion of balance or equilibrium between assimilation and accommodation suggests that things are never known by themselves, but always in relation to "old" knowledge. Through these processes we reconstruct our "old" experiences. Assimilation and accommodation do not occur at random but rather move through certain fixed stages of development.

Stages of Cognitive Development

Cognitive development through assimilation and accommodation occurs as children go through stages. Although these stages are innate and fixed for children in all cultures, the age at which a stage emerges

varies from child to child according to his capacities and according to the culture in which he lives. Moreover, the stages do not appear discretely but often overlap.

Piaget has identified four stages of cognitive development. The first is the *sensory-motor stage*, in which children learn motor behavior. In general, this first stage develops between birth and two years of age. Next is the *preoperational stage*, in which children acquire the ability to conceptualize and use language. This develops between the ages of 2 and 7. Children's ability to apply logical thought to concrete problems appears in the *concrete operations stage*. This stage appears between the ages of 7 and 11. The fourth is the *formal operations stage*, taking place between the ages of 11 and 15. It is in this stage that children's cognitive structures reach their greatest level of development; children learn to apply logic to problems of all sorts. These stages do not occur separately and discretely, but each one leads to the emergence of the next one.

The developmental stages are fixed and their order of succession is continuous, but the developmental process is affected by organic growth, exercise, experience, social interaction, transmission, and equilibrium. While organic growth or maturation is an essential aspect of cognitive development, the influence of the child's physical and sociocultural environment becomes increasingly important as the child grows older. Exercise and experience in acting upon objects are important in cognitive development, for neither assimilation nor accommodation can take place unless children interact with their environment.

Social interaction and transmission are important in the child's development of such concepts as love, loyalty, and courage. These concepts do not have objects as referents. Children cannot construct these concepts by looking at things. They must develop through interaction with other individuals and through the interchange of thought.

The last factor affecting the developmental process is equilibrium. Equilibrium is not simply a balance of forces. Rather, it is a process of self-regulation. It is the internal mechanism that regulates and integrates organic growth, exercise, experience, social interaction, and transmission.

The discussion so far may seem to imply that Piaget's theory is concerned only with the intellectual development of the child—separate and different from his affective or emotional development. However, it should be pointed out that there is no behavior, however intellectual, that does not involve affective factors as motives. Similarly, the child can have no emotion unless he has a cognitive structure that is based on earlier perceptions and understandings. Hence, the two aspects, affective and cognitive, are inseparable and irreducible.

Thinking and Language

Language is the usual stimulus for challenging the child to think and to explore. But language cannot do this unless the child has developed formal mechanisms of thinking. Piaget points out that a child's ability to think is frequently ahead of his ability to use language. A 6-year-old child knows more than he can put in words. But teachers frequently assume that "if he can't say it, he must not know it."

Verbal language alone is unsuitable as a means of stimulating the development of thinking in children. A premature emphasis on language as a medium for thinking is likely to result in a child functioning below his potential.

Thinking and Development

For many people, Piaget's greatest contribution was his identification of the successive stages of intellectual development in children. Knowing these stages is useful for teachers, but this knowledge can be abused if a teacher uses the stages for labeling a child and neglects to look at the child as an individual. Only by stimulating thinking at successively higher levels (that is, higher relative to the child's stage of development) will development of thinking take place.

All human activity is permeated by thinking, but not at a fixed level. For example, a 2-year-old child can think about a car. His thinking is limited by his developmental level and by the experiences he has had with cars. As he reaches a higher developmental level and acquires more knowledge of cars, his thinking about them will become more complex and sophisticated.

Piaget rejects the idea of a rigid timetable for developmental stages.

Piaget always tied the stage concept of development to a task rather than to the child as a whole. He emphasized that within developmental stages, human beings vary greatly—variations occur between individuals and within individuals and on the same task. The word "stages" refers to differences in the structure of thinking. These differences are not merely due to an increase in information. If a 6-year-old child learns the telephone number of a friend, he increases his store of information, but it is not likely to change the structure of his knowledge. If this child, however, plays a permutation game and thus begins to discover a principle of sequential arrangements, this discovery can lead the child to a new understanding of numerical order and a new manner of structuring it. In short, there may come about a change in the development of his thinking and not merely an increase in the amount of information he has.

Thinking and Children

The child is constantly constructing and reconstructing his understanding of himself and his world. Through thinking, the child organizes his environment. The function of education, then, is to help the child develop as a thinker.

The thinking mechanisms that a child has must be activated by thinking activities that are used in connection with a task at hand. In other words, thinking is the use of the child's intelligence. It is important for its own sake. A child must be stimulated to think in order to bring about further development in his thinking capacity.

All thinking results from the coordination of external actions, not from sitting in a row and listening to a lecture. The child is thinking when he sees relationships between actions that he exerts upon himself and upon his world. In order to think, a child must be active, not passive.

When we engage children in thinking activities, it is not the muscles or the senses that we are trying to train, but the thinking that controls specific muscle or sense activities. All activities are to be done with the emphasis on thinking, not on performance. For example, playing, running, singing, and exploring are four activities that carry their own reward for children. Satisfying one's curiosity—"What kind

of bug is this?"—also fits in this class of activities that are valuable in themselves.

The purpose of thinking activities is to provide children with experiences that are designed to develop their thinking. The child who is encouraged to participate in problem-solving play that is neither too easy nor too difficult is not bored. He is thinking at a level that challenges him. His incentive comes from his own success, not from a feeling of inferiority or superiority with regard to others. His reward comes from the process instead of the product. In other words, when children are playing and are spontaneously involved in that play, they are thinking. For thinking to develop, each child must be given freedom within a structure to work at his own level, at his own speed, and in his own style.

Thinking and Teachers

Implementing Piaget's theories becomes a challenge for teachers and other people who work with children. The teacher must see that activities are stimulating for all the children in the classroom. Children must be grouped according to different criteria and different tasks. This requires that the teacher know each child. Furthermore, the teacher must become adept at on-the-spot analysis, must be able to pick up clues that a child is having trouble. Some of these are squinting, squirming, clenching fists, holding the head too close to the paper, or refusing to perform tasks. These actions tell the teacher when to vary his approach. The teacher must be sensitive to the sources of boredom in a classroom. These are situations that expect too much of the student and situations that expect too little of him. The teacher must be a diagnostician, monitoring student activities and changing the level of a task as the need for change is indicated.

The idea of the classroom as a place for thinking activities puts the emphasis on the child as a thinker-in-action rather than on the child as one who imitates and obeys the teacher. The teacher must provide activities that develop thinking strategies that can be applied to a wide range of academic subjects, such as reading, writing, and arithmetic. The teacher must raise or lower the demands of a task according to the developmental level of the child. Activities must be developmentally

appropriate so as to challenge the child's thinking, neither so difficult as to cause failure nor so easy as to be boring. For example, a child may do simple sums using poker chips as counters. He may be told to add three poker chips and one poker chip and then tell how many he has. Or he may be given four poker chips and told to take away one poker chip and then tell how many remain. In both cases the content is the same, but in each case the thinking structure is different.

If a teacher is to emphasize thinking, he must focus on intrinsic motivation—that is, the motivation that is inside the student. If children are given guidance, they will understand that what counts is their own activity and that high-level functioning is its own reward. The teacher is the stimulator of the development of thinking by guiding the child to seek out, select, and deal with objects and happenings in his environment.

The teacher must wait for the skills of the child to develop, while at the same time reinforcing the child for putting forth his own best efforts. And as the teacher watches for thinking to blossom from within, he must be patient and accepting of individual differences.

For children to become intellectually healthy and stay that way, they must be in environments in which they can think. These thinking environments must be happy places; they should be provided not only in schools but also in homes and places of work.

Conclusion

Piaget's studies of children's thinking have shown us that knowledge or truth cannot be imparted directly as a ready-made product. Rather, the child must be left free to construct knowledge on his own—that is, free to think and free to develop as a thinker. The growing child, in other words, must be encouraged to constantly construct his understanding of himself and his world.

Teachers, therefore, must use active methods that give broad scope to the spontaneous curiosity of the child and that require every new truth to be rediscovered or at least reconstructed by the student.

If teachers are to stimulate the development of thinking, the school must be founded on the theory of action-intelligence—an approach to knowledge that leads to responsible and intelligent behavior.

And that, after all, is why we have schools.

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